

Analisis Process Mining pada Proses Penanganan Pasien Sepsis Menggunakan Event Log Publik

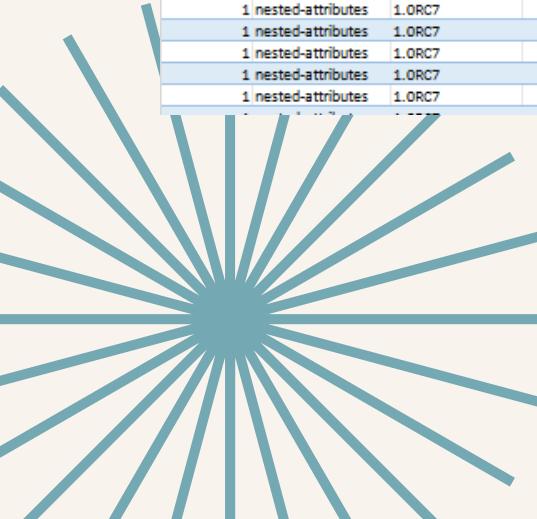


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DATASET & TAHAPAN ANALISIS

link dataset

xes.versi	xes.features	openxes.version	name	prefix	uri	scop	key	value	key2	value2	name2	keys	key3	value3	key4	value	key5	value	key6
1 nested-attributes	1.0RC7	Organizational	org	org	http://www.xes-standard.org/org.xesext														
1 nested-attributes	1.0RC7	MetaData_Organization	meta_org	meta_org	http://www.xes-standard.org/meta_org.xesext														
1 nested-attributes	1.0RC7	MetaData_Time	meta_time	meta_time	http://www.xes-standard.org/meta_time.xesext														
1 nested-attributes	1.0RC7	Time	time	time	http://www.xes-standard.org/time.xesext														
1 nested-attributes	1.0RC7	MetaData_3TU	meta_3TU	meta_3TU	http://www.xes-standard.org/meta_3TU.xesext														
1 nested-attributes	1.0RC7	Lifecycle	lifecycle	lifecycle	http://www.xes-standard.org/lifecycle.xesext														
1 nested-attributes	1.0RC7	MetaData_LifeCycle	meta_life	meta_life	http://www.xes-standard.org/meta_life.xesext														
1 nested-attributes	1.0RC7	Concept	concept	concept	http://www.xes-standard.org/concept.xesext														
1 nested-attributes	1.0RC7	MetaData_Concept	meta_concept	meta_concept	http://www.xes-standard.org/meta_concept.xesext														
1 nested-attributes	1.0RC7	MetaData_General	meta_general	meta_general	http://www.xes-standard.org/meta_general.xesext														
1 nested-attributes	1.0RC7			trace	concept:name	DEFAULT													
1 nested-attributes	1.0RC7			event	lifecycle:transition	DEFAULT	time:timestamp	1970-01-01T01:00:00.000+01:00											
1 nested-attributes	1.0RC7			event	concept:name	DEFAULT	time:timestamp	1970-01-01T01:00:00.000+01:00											
1 nested-attributes	1.0RC7			event	org:group	DEFAULT	time:timestamp	1970-01-01T01:00:00.000+01:00											
1 nested-attributes	1.0RC7				concept:name	concept:name													
1 nested-attributes	1.0RC7				org:group	org:group													
1 nested-attributes	1.0RC7							meta_org:different_resources_standard_deviation		0									
1 nested-attributes	1.0RC7																meta_org:different_resources_min	1	
1 nested-attributes	1.0RC7																		
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 CRP	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Release B	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Release A	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Release D	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Release C	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Release E	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Admission IC	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Return ER	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 ER Triage	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 IV Antibiotics	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Leucocytes	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 ER Registration	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 IV Liquid	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 Admission NC	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 LacticAcid	
1 nested-attributes	1.0RC7																meta_concept:named_events_total	15214 ER Sepsis Triage	
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 A	3.297
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 B	7.725
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 C	1.003
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 D	0.045
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 E	0.745
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 F	0.206
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 G	0.141
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 H	0.052
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 I	0.12
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 J	0.025
1 nested-attributes	1.0RC7																meta_org:group_events_average	14.49 K	0.017



KODE/SCRIPTS EXPLORATORY ANALYSIS

[link](#) [github](#)

```
=====
# VISUALIZATION
=====

figure(figsize=(10, 5))
bar(activities.keys(), activities.values())
xticks(rotation=90)
title("Frequency of Activities")
tight_layout()
savefig("results/activity_frequency.png")
close()

figure(figsize=(8, 5))
hist(case_durations, bins=30)
title("Distribution of Case Duration")
xlabel("Duration (seconds)")
ylabel("Number of Cases")
tight_layout()
savefig("results/case_duration_distribution.png")
close()

"\nGrafik berhasil disimpan di folder results"
```

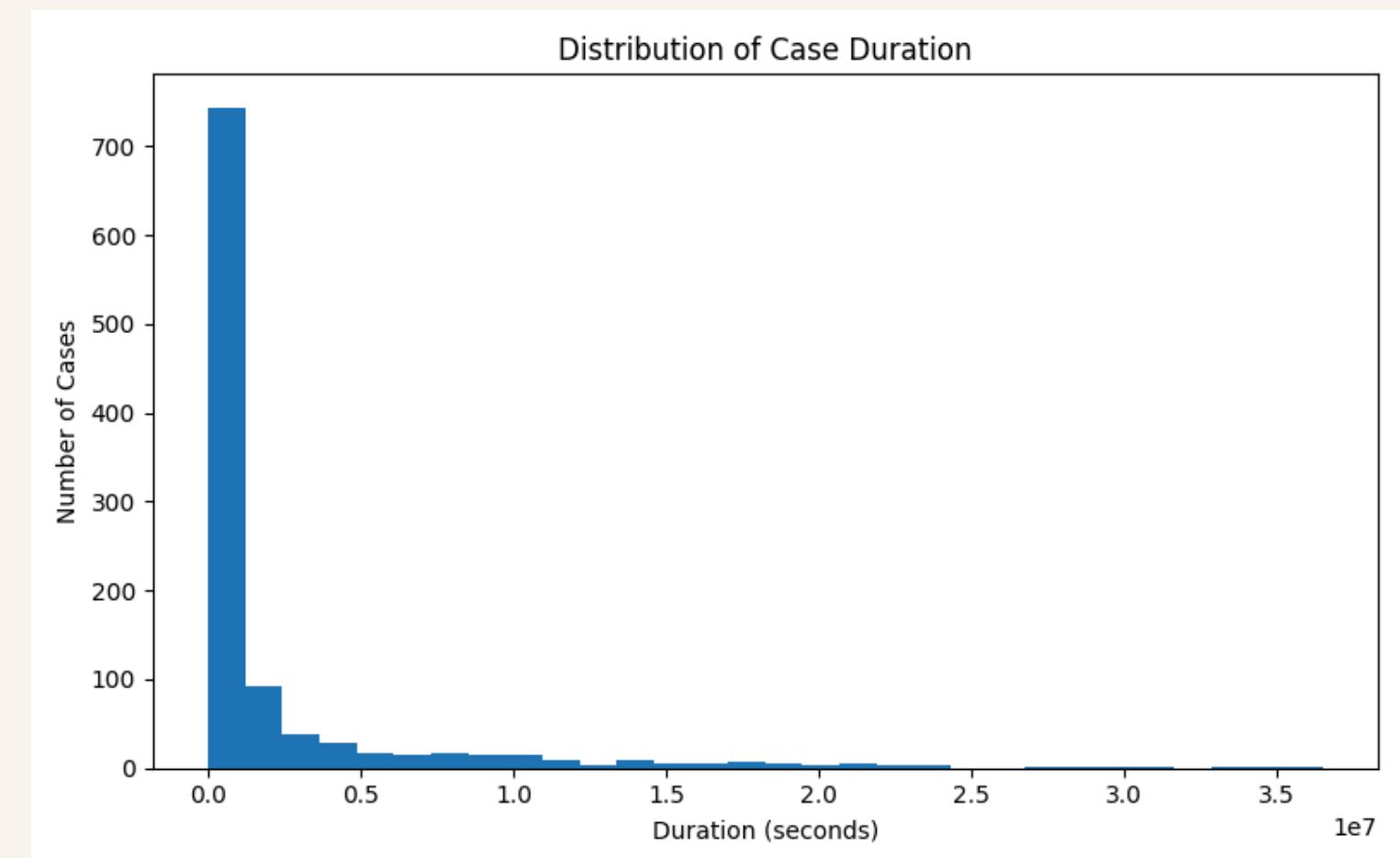
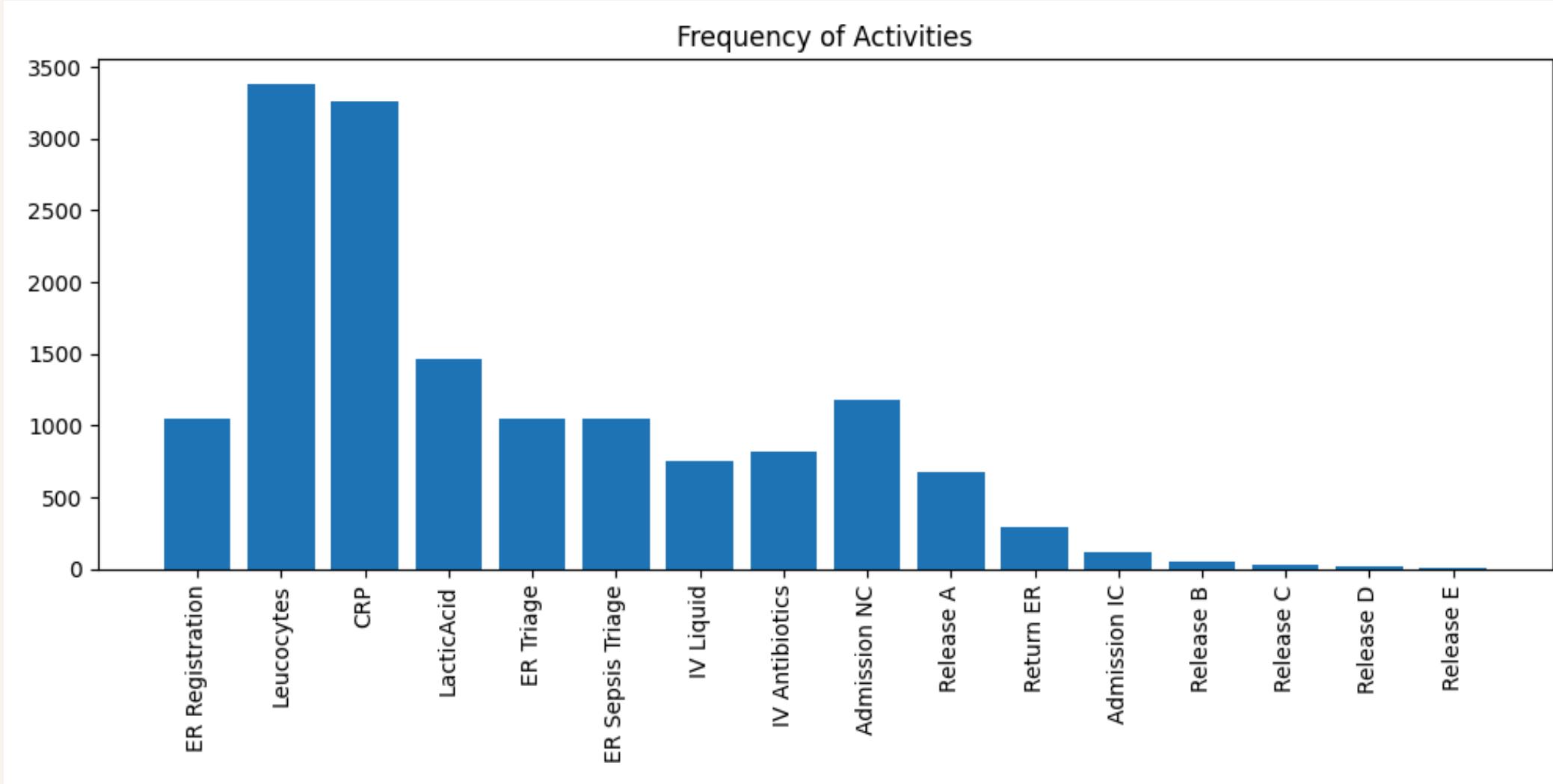
```
33
34     # =====
35     # VISUALIZATION
36     # =====
37     plt.figure(figsize=(10, 5))
38     plt.bar(activities.keys(), activities.values())
39     plt.xticks(rotation=90)
40     plt.title("Frequency of Activities")
41     plt.tight_layout()
42     plt.savefig("results/activity_frequency.png")
43     plt.close()

44
45     # =====
46     # MOST FREQUENT ACTIVITIES
47     # =====
48     sorted_activities = sorted(activities.items(), key=lambda x: x[1], reverse=True)
49
50     print("\nAktivitas paling sering:")
51     for act, freq in sorted_activities[:5]:
52         print(f"{act}: {freq}")

53
54     # =====
55     # START & END ACTIVITIES (FIXED)
56     # =====
57     start_act = start_activities.get_start_activities(log)
58     end_act = end_activities.get_end_activities(log)
59
60     print("\nAktivitas awal dominan:")
61     print(start_act)
62
63     print("\nAktivitas akhir dominan:")
64     print(end_act)
```

GRAFIK EXPLORATORY ANALYSIS

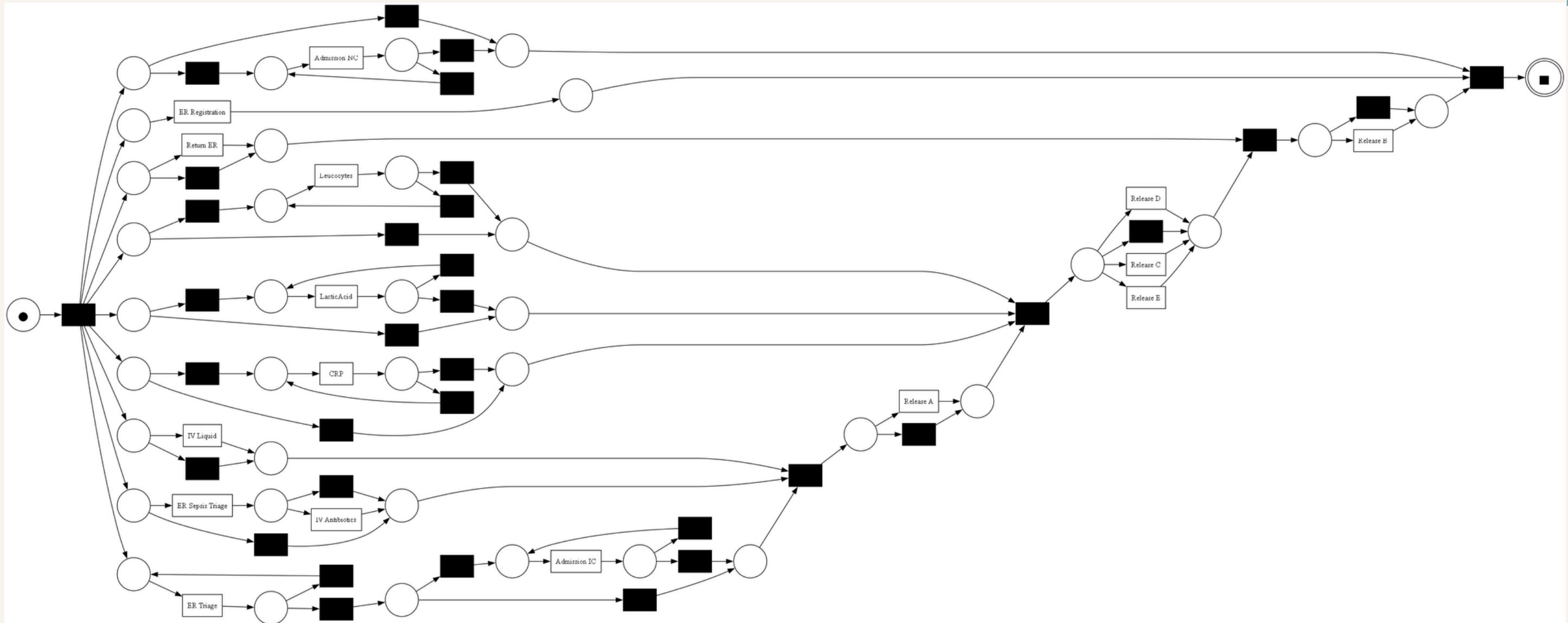
link github

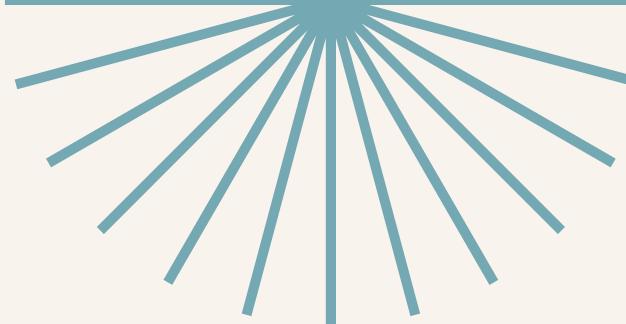


KODE/SCRIPTS PROCESS DISCOVERY

```
1  from pm4py.objects.log.importer.xes import importer as xes_importer
2  from pm4py.algo.discovery.inductive import algorithm as inductive_miner
3  from pm4py.objects.conversion.process_tree import converter as pt_converter
4  from pm4py.visualization.petri_net import visualizer as pn_visualizer
5
6  # =====
7  # LOAD EVENT LOG
8  # =====
9  log = xes_importer.apply("data/sepsis_cases.xes")
10 print("Event log berhasil dimuat")
11
12 # =====
13 # PROCESS DISCOVERY
14 # =====
15 print("Menjalankan Inductive Miner...")
16 process_tree = inductive_miner.apply(log)
17 print("Process Tree berhasil dibuat")
18
19 # =====
20 # CONVERT TO PETRI NET
21 # =====
22 net, initial_marking, final_marking = pt_converter.apply(process_tree)
23 print("Petri Net berhasil dikonversi")
24
25 # =====
26 # VISUALIZATION
27 # =====
28 gviz = pn_visualizer.apply(net, initial_marking, final_marking)
29 pn_visualizer.save(gviz, "results/process_model.png")
30
31 print("Model proses berhasil disimpan di folder results/")
32
```

PROCESS DISCOVERY





KODE/SCRIPTS CONFORMANCE CHECKING

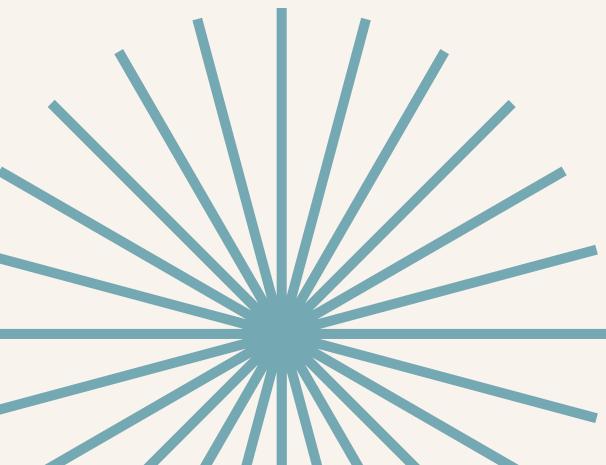
link github

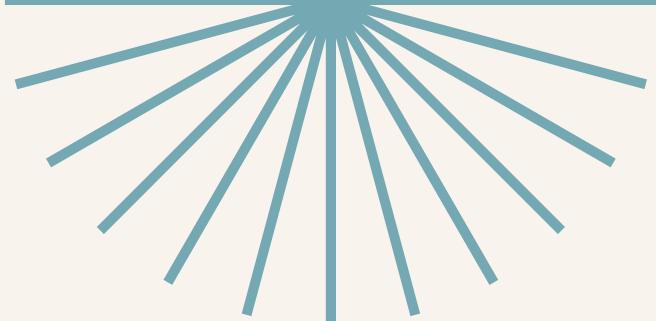
```
1  from pm4py.objects.log.importer.xes import importer as xes_importer
2  from pm4py.algo.discovery.inductive import algorithm as inductive_miner
3  from pm4py.objects.conversion.process_tree import converter as pt_converter
4  from pm4py.algo.conformance.alignments.petri_net import algorithm as alignments
5
6  # =====
7  # LOAD EVENT LOG
8  # =====
9  log = xes_importer.apply("data/sepsis_cases.xes")
10 print("Event log berhasil dimuat")
11
12 # =====
13 # PROCESS DISCOVERY
14 # =====
15 process_tree = inductive_miner.apply(log)
16 net, initial_marking, final_marking = pt_converter.apply(process_tree)
17 print("Model Petri Net siap untuk conformance checking")
18
19 # =====
20 # CONFORMANCE CHECKING (ALIGNMENT)
21 # =====
22 print("Menjalankan conformance checking (alignment)...")
23
24 aligned_traces = alignments.apply_log(
25     log,
26     net,
27     initial_marking,
28     final_marking
29 )
30
31 # =====
32 # FITNESS CALCULATION
33 # =====
34 fitness_values = [
35     align["fitness"] for align in aligned_traces if "fitness" in align
36 ]
37
38 average_fitness = sum(fitness_values) / len(fitness_values)
39
40 print("Jumlah trace:", len(aligned_traces))
41 print("Rata-rata fitness:", round(average_fitness, 4))
```

CONFORMANCE CHECKING

link github

```
C:\Users\asus\Documents\Semester 5\data mining\20123044_C1.23_UASProsesMining-main>python scripts\step3_conformance_checking.py
parsing log, completed traces :: 100%|██████████| 1050/1050 [00:00<00:00, 2235.83it/s]
Event log berhasil dimuat
Model Petri Net siap untuk conformance checking
Menjalankan conformance checking (alignment)...
aligning log, completed variants :: 100%|██████████| 846/846 [12:28<00:00, 1.13it/s]
Jumlah trace: 1050
Rata-rata fitness: 1.0
```





PRECISION, GENERALIZATION, SIMPLICITY

link github

Precision

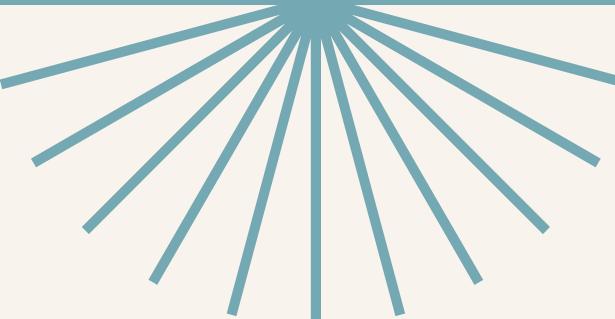
Model tidak memperbolehkan perilaku yang tidak terdapat pada event log.

Generalization

Model mampu menangkap variasi proses yang wajar dari data.

Simplicity

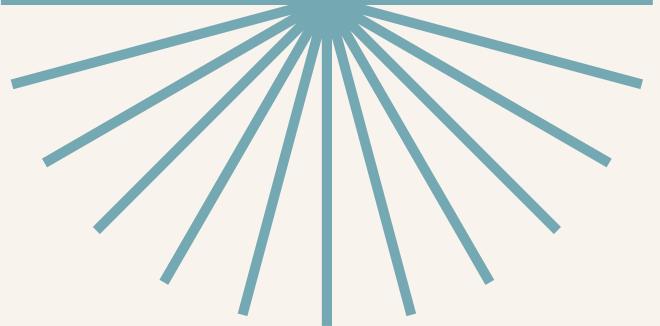
Model memiliki struktur yang cukup sederhana sehingga mudah dipahami.



link github

BOTTLENECK ANALYSIS

A	B	C
1 Aktivitas	Durasi (detik)	
2 Release E	9742100	
3 Release A	7063078.95323741	
4 Release C	5886817	
5 Release D	4803766	
6 Admission NC	123779.52054794521	
7 CRP	60556.64296802235	
8 Leucocytes	46083.96166516921	
9 Admission IC	18362.34188034188	
10 LacticAcid	14426.128294036062	
11 IV Antibiotics	5899.372282608696	
12 IV Liquid	4059.310391363023	
13 ER Sepsis Triage	1193.272	
14 Return ER	1117.333333333333333	
15 Release B	810	
16 ER Registration	643.9571428571429	
17 ER Triage	405.2369172216936	



link github

REKOMENDASI PERBAIKAN PROSES

PENUTUP
